

Surveys

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REPORT OF
FOREST INSECT SURVEYS
IN OREGON AND WASHINGTON

Season of 1953

Compiled by
Oregon State Board of Forestry
and
Bureau of Entomology and Plant Quarantine
United States Department of Agriculture

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REPORT OF FOREST INSECT SURVEYS IN OREGON AND WASHINGTON

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INTRODUCTION

Forest owners and managers in Oregon and Washington were faced with a gigantic insect control and salvage problem in 1952 as a result of the worst forest insect year on record. The situation in 1953 continued to be serious. Spruce budworm and Douglas fir beetle infestations declined, but several of the other major forest insect pests became more destructive. In 1953 epidemic infestations were recorded on 8,196,320 acres or approximately 17 percent of the total forested area of the two states.

Two cooperative forest insect surveys were conducted in Oregon and Washington in 1953. The first was an intensive aerial and ground survey of the Douglas fir region to record the spread and intensity of the barkbeetle-blowdown problem that became critical in 1952. 1/ The second, or regular regional forest insect survey, included aerial and ground observations of the entire forested area to record data on all the major forest insects currently epidemic in the two states.

The results of the 1953 Douglas fir beetle-blowdown survey will be reported later. The results of the regional forest insect survey are summarized in this report. Part I is a statement of the spruce budworm situation, including summaries of data (Graph 1 and Tables 1 and 2). Part II is a brief discussion of other major forest insect problems recorded in 1953. Part III contains an acknowledgment of the cooperation on the 1953 survey; summaries of the field data (Tables 3 to 6); a list of spruce budworm reports and publications; and maps showing the status of the spruce budworm and three other major forest insect pests in 1953.

1/ Final Report on the 1952 Blowdown and Bark Beetle Survey in the Douglas fir Regional of Oregon and Washington. Pacific Northwest Forest and Range Experiment Station and Bureau of Entomology and Plant Quarantine. July, 1953.

PART I - SPRUCE BUDWORM PROBLEM

General Statement

Upon the recommendation of the Northwest Forest Pest Action Committee, five cooperative aerial spraying projects have been completed during the period 1949-1953 to control an aggressive and widespread epidemic of the spruce budworm (*Choristoneura fumiferana*) in Oregon and Washington (Graph 1). During these years, a total of 3,152,247 acres of epidemic infestations have been successfully treated at a cost of about \$3,324,000 or \$1.06 per acre.

The primary accomplishments of this control program have been:

1. The epidemic, which started in 1944 and reached a peak of 2,276,000 acres in 1949, has been reduced to 1,136,000 acres in 1953.
2. The acreage of heavy defoliation on which tree killing by the budworm was occurring has been reduced from 887,000 acres in 1949 to 141,000 acres in 1953.
3. General killing by the spruce budworm has been confined to less than 10,000 acres.
4. Epidemic infestations have been eliminated in western Oregon and tree killing has been prevented.
5. Epidemic infestations have been eliminated from the eastern Oregon Cascades area and tree killing has been kept to a minimum.
6. Epidemic infestations on extensive areas in the Blue Mountains of Oregon and Washington have been controlled and serious losses prevented.
7. Protection of valuable watersheds has been achieved and a potentially serious forest fire hazard has been averted.
8. The practicability of aerial spraying to control the budworm has been demonstrated.

As stated in previous survey reports, direct control has been recommended and undertaken only as an emergency measure to forestall spread of the epidemic and widespread damage until natural control takes over. Since 1950, there have been local indications that natural control was becoming increasingly effective; however, on most of the unsprayed areas it has not yet become potent enough to turn the epidemic downward.

The Spruce Budworm Situation in 1953

The present report summarizes the status of the spruce budworm in Oregon and Washington ^{1/} in 1953. A summary of the 1953 infestations by intensities and ownership classes is presented in Tables 1 and 2, which follow.

During 1953, the aerial survey techniques used during past surveys were again employed. The aerial phase of the 1953 survey (Table 3) started on July 15 and was concluded on October 6, except for a small area in southwestern Oregon where dense smoke and haze made it impossible to complete the survey.

The total acreage of spruce budworm epidemic infestations recorded in 1953 shows a marked reduction from 1952, as follows:

Area	1953	1952
Blue Mountains, Oregon	994,420 acres	1,407,680 acres
Blue Mountains, Washington	118,880 acres	127,280 acres
Western Oregon	0 acres	23,840 acres
Eastern Washington Cascades	22,720 acres	19,840 acres
Eastern Oregon Cascades	0 acres	0 acres
Area Totals	1,136,020 acres	1,578,640 acres
Total for Oregon	994,420 acres	1,431,520 acres
Total for Washington	141,600 acres	147,120 acres

The standards for evaluating the degree of epidemic infestations in 1953 were the same as in past surveys, as follows:

Light - Defoliation light, barely visible from the air; no tree killing expected for at least two years.

Moderate - Defoliation moderate; no tree killing expected for at least one year.

Heavy - Defoliation moderate to severe; some tree killing in progress, general tree killing probable next year.

Very Heavy - Defoliation severe; general tree killing in progress.

Dead - Defoliation complete; trees predominantly dead on extensive areas.

Since 1951, only light, moderate, and heavy epidemic infestations have been recorded. There have been no new centers of very heavy defoliation or dead commercial timber as a direct result of budworm feeding. However, it should be understood, that on several of the unsprayed units, where the budworm has been in epidemic status since 1949, the vigor of both Douglas fir and true firs has been greatly reduced as a result of repeated defoliations. Reproduction, saplings and poles in dense thickets have been killed and the upper crowns of larger trees have become "spike topped." Growth rates have been materially reduced and bark beetle outbreaks stimulated.

^{1/} Exclusive of Pend Oreille, Spokane and Stevens Counties in Washington which are covered by the U.S. Forest Service in Region 1.

GRAPH I
PROGRESS OF SPRUCE BUDWORM EPIDEMIC IN OREGON AND WASHINGTON

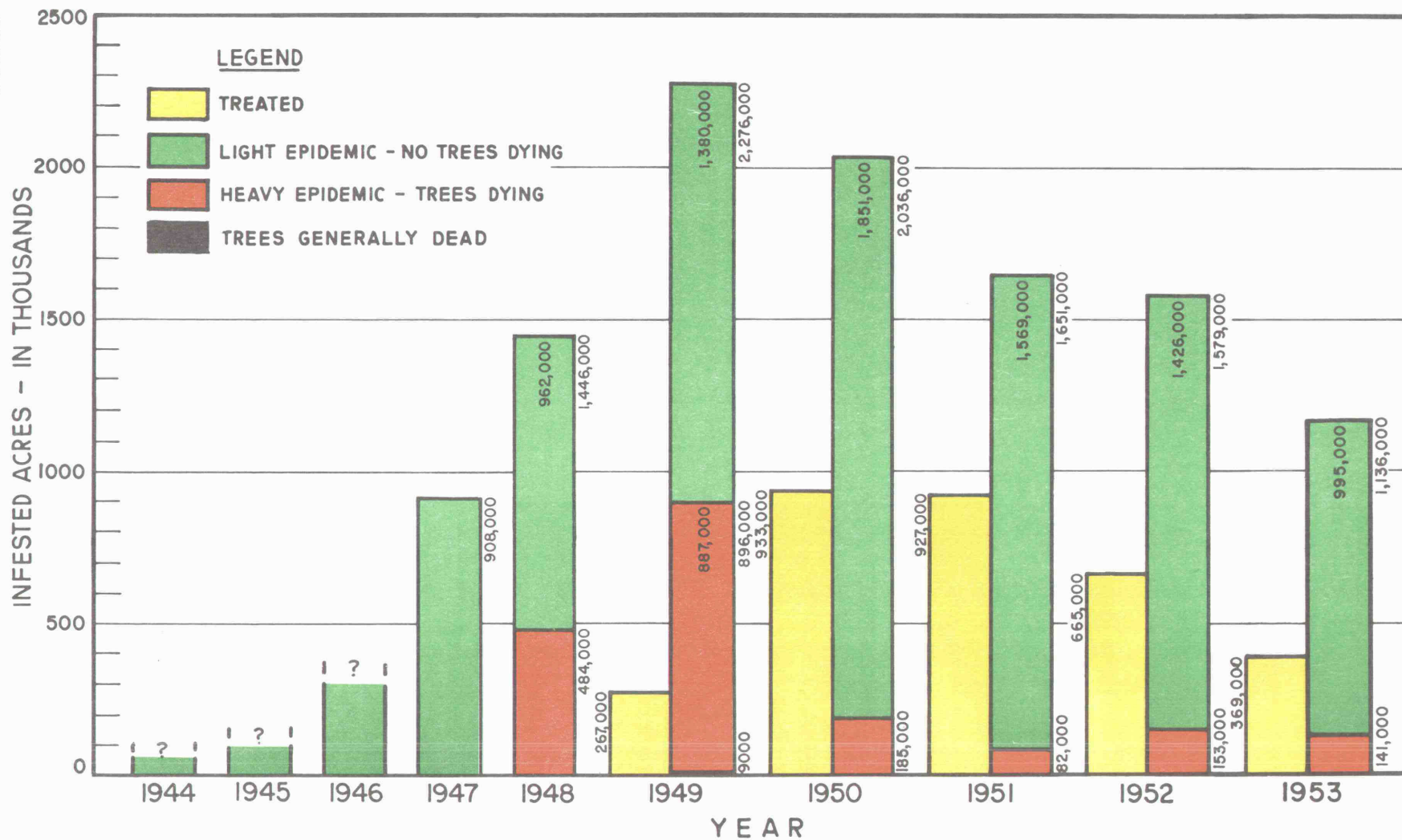


TABLE 1. SUMMARY OF 1953 SPRUCE BUDWORM EPIDEMIC INFESTATIONS BY INTENSITIES ^{1/}

AREA AND UNIT	INTENSITY OF INFESTATION							
	Light		Moderate		Heavy		Total	
	Acres	%	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS - OREGON								
(1) Ochoco	176,600	93.5	12,250	6.5			188,850	100
(2) Aldrich Mt.	8,710	100.0					8,710	100
(3) Malheur	71,850	37.5	70,230	36.7	49,440	25.8	191,520	100
(4) Susanville	13,700	100.0					13,700	100
(5) La Grande	39,180	76.1	11,920	23.1	390	0.8	51,490	100
(6) Powder River	33,950	81.2	7,870	18.8			41,820	100
(7) Baker Watershed	16,130	82.3	3,460	17.7			19,590	100
(8) Eagle Creek	18,440	39.7	21,570	46.5	6,400	13.8	46,410	100
(9) Moss Spring	8,330	34.7	13,000	54.1	2,690	11.2	24,020	100
(10) Joseph	48,050	35.9	53,880	40.3	31,830	23.8	133,760	100
(11) Snake	63,800	40.3	81,760	51.7	12,570	8.0	158,130	100
(12) Chesnimus	17,060	18.5	58,690	63.7	16,350	17.8	92,100	100
(13) Troy	9,760	40.1	12,480	51.3	2,080	8.6	24,320	100
TOTAL FOR OREGON	525,560	52.9	347,110	34.9	121,750	12.2	994,420	100
BLUE MOUNTAINS - Washington								
(14) Saddle Mt	6,880	5.8	99,520	83.7	12,480	10.5	118,880	100
EASTERN WASHINGTON CASCADES								
(15) Wenatchee	4,640	20.4	11,360	50.0	6,720	29.6	22,720	100
TOTAL FOR WASHINGTON	11,520	8.1	110,880	78.3	19,200	13.6	141,600	100
GRAND TOTAL	537,080	47.3	457,990	40.3	140,950	12.4	1,136,020	100

369,171
1,505,191

^{1/} Does not include 369,171 acres treated during the 1953 control project.

TABLE 2. SUMMARY OF 1953 SPRUCE BUDWORM EPIDEMIC INFESTATIONS BY OWNERSHIPS 1/

AREA AND UNIT	OWNERSHIP CLASSES					
	Federal		State Private and Other		Total	
	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS - OREGON						
(1) Ochoco	169,960	90.0	18,890	10.0	188,850	100
(2) Aldrich Mt.	8,130	93.3	580	6.7	8,710	100
(3) Malheur	116,950	61.1	74,570	38.9	191,520	100
(4) Susanville	9,900	72.3	3,800	27.7	13,700	100
(5) La Grande	27,230	52.9	24,260	47.1	51,490	100
(6) Powder River	32,860	78.6	8,960	21.4	41,820	100
(7) Baker Watershed	11,390	58.1	8,200	41.9	19,590	100
(8) Eagle Creek	45,390	97.8	1,020	2.2	46,410	100
(9) Moss Spring	23,860	99.3	160	0.7	24,020	100
(10) Joseph	116,010	86.7	17,750	13.3	133,760	100
(11) Snake	155,620	98.4	2,510	1.6	158,130	100
(12) Chesnimus	89,420	97.1	2,680	2.9	92,100	100
(13) Troy	24,320	100.0			24,320	100
TOTAL FOR OREGON	831,040	83.6	163,380	16.4	994,420	100
BLUE MOUNTAINS - WASHINGTON						
(14) Saddle Mt.	112,920	95.0	5,960	5.0	118,880	100
EASTERN WASHINGTON CASCADES						
(15) Wenatchee	13,280	58.6	9,440	41.4	22,720	100
TOTAL FOR WASHINGTON	126,200	89.1	15,400	10.9	141,600	100
GRAND TOTAL	957,240	84.3	178,780	15.7	1,136,020	100

1/ Does not include 369,171 acres treated during the 1953 control project.

In both Oregon and Washington there are extensive areas on which the spruce budworm is present in numbers too small to cause defoliation detectable during the aerial surveys. To record these very light infestations, as a precaution against the development of future epidemic outbreaks of the budworm, cooperative ground sampling surveys have been conducted each year since 1949.

In 1953, the ground survey plan was changed from that employed during previous years. Permanent sample plots were randomly selected from a large series of previously used temporary sampling points in nearly every county of western Oregon and Washington and in most counties bordering the Cascade Range in the eastern portion of the two states. A total of 283 plots was selected in Oregon and 203 plots in Washington. Meetings were held in Salem, Oregon on June 17 and in Olympia, Washington on June 19 to explain the new survey procedures and assign plots to cooperators. At the end of the survey season, 408 plots had been established and examined. The budworm was found to be present on 39 plots (9.6%) and absent on 369 plots (90.4%). The participants and results of the 1953 ground survey are listed in Tables 4 and 5.

1953 Spruce Budworm Situation by Areas and Units

The findings of the 1953 spruce budworm survey will be discussed by areas and numbered units shown in Tables 1 and 2 and on Map 1 in the Appendix.

Western Oregon Area

With the sudden buildup of epidemic populations of the spruce budworm in the high-value Douglas fir stands of western Oregon in 1948, all centers of epidemic infestation in this area, plus sizable buffer zones of light infestation, have been treated in the year following detection. In this way the budworm has been kept from extensive spreading and tree-killing has been entirely prevented. A summary of the observed infestations and the control operations in western Oregon to date is as follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zones)</u>
1948	86,200 acres	1949	160,230 acres
1949	88,640 acres	1950	119,730 acres
1950	96,405 acres	1951	161,919 acres
1951	56,960 acres	1952	78,573 acres
1952	23,840 acres	1953	77,835 acres
1953	None		

During the 1953 spruce budworm control project, 77,835 acres (23,840 acres of epidemic infestations plus 53,995 acres of buffer zones) were treated in the Western Oregon Area. The aerial spraying was again centered on the Willamette National Forest, with most of the spraying on the upper portions of the South and North Fork Santiam River drainages. The control of the budworm was satisfactory ranging from 88.5 to 100 percent on individual spray blocks and averaging 98.1 percent for the unit.

In the ground survey of the Western Oregon Area, 234 plots were established and examined. The budworm was found to be present on 23 plots (9.8%) and absent on 211 plots (90.2%).

For the first time since 1948, there were no centers of spruce budworm epidemic infestations recorded in the Western Oregon Area during the aerial survey.

Eastern Oregon Cascades Area

In 1953, for the second consecutive year, no epidemic infestations of the spruce budworm were detected on the Eastern Oregon Cascades Area. Trees on the treated units show remarkable recovery and it is evident that the control work has prevented any serious losses on this area.

A summary of the recorded infestations and the control operations in this areas is as follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zones)</u>
1948	102,790 acres	1949	106,000 acres
1949	39,990 acres	1950	40,338 acres
1950	104,460 acres	1951	160,554 acres
1951	77,440 acres	1952	70,415 acres
1952	None	1953	None
1953	None		

A total of 24 permanent plots for recording budworm trends was established during the 1953 ground survey. The budworm was found to be present on 11 plots (45.8%) and absent on 13 plots (54.2%).

No spruce budworm control measures will be needed on this area in 1954. However, constant surveillance should be maintained to detect any build-up of budworm populations that would again threaten the fir stands of the area as well as those in western Oregon.

Blue Mountains - Oregon Area

As shown in Tables 1 and 2 and on Map 1, all the acreage of spruce budworm epidemic infestations recorded by the 1953 survey in Oregon was confined to the Blue Mountains Area. It is encouraging to report that there was a definite decrease in the acreage of infestation in this area as shown by the following comparisons:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreages Treated (Includes Buffer Zones)</u>
1947	665,000 Acres		
1948	1,117,000 Acres		
1949	1,939,000 Acres		
1950	1,515,000 Acres	1950	747,781 Acres
1951	1,329,480 Acres	1951	479,164 Acres
1952	1,407,680 Acres	1952	371,511 Acres
1953	994,420 Acres	1953	291,336 Acres

This does not agree with 1950 report which shows 1,810,080. nearly 300,000 Ac. difference

The 1953 aerial spraying project in the Blue Mountains was conducted on the following control units with excellent results:

<u>Control Unit</u>	<u>Acreage Treated</u>	<u>Range of Mortality By Blocks (%)</u>	<u>Average Mortality (%)</u>
Starkey	125,896	94.4 - 100	99.0
Johnson Creek	99,745	91.7 - 100	99.2
Dale	52,288	99.0 - 100	99.5
Desolation Creek	13,407	98.7 - 100	99.3

Handwritten calculations: 125,896 + 99,745 = 225,641; 225,641 + 52,288 = 277,929; 277,929 + 13,407 = 291,336

With the budworm known to be present in epidemic numbers on practically all unsprayed fir stands in this area, no detailed ground sampling surveys have been conducted since 1949.

The status of the spruce budworm in the Blue Mountains - Oregon Area in 1953 will be discussed by the 13 control units recorded during the survey.

1. Ochoco Unit - The 1953 spruce budworm situation on and adjacent to the Ochoco National Forest is noticeably improved over that reported in 1952. The current epidemic totals 188,850 acres (which is 84,430 acres less than in 1952) and is classified as 176,000 acres (93.5%) light and 12,250 acres (6.5%) moderate. In 1952, 60.5 percent of the infestation was of moderate intensity. The ownership in the 1953 infestation is 169,960 acres (90.0%) federal and 18,890 acres (10.0%) private, state or other.

The weakening of larger trees through repeated defoliations and the deforming of smaller trees by top killing is continuing but control needs remain low for the following reasons: (1) The defoliation has not yet reached tree killing intensity, (2) abnormal killing of budworm-weakened trees by bark beetles has not yet occurred, (3) previously treated units or new units of timber are not threatened by the present epidemic, and (4) the fluctuating nature of the epidemic on this unit indicates that it may subside without causing noticeable mortality.

2. Aldrich Mountain Unit - This unit on the Malheur National Forest was found to contain 8,710 acres of light epidemic infestation in 1953. The ownership is 8,130 acres (93.3%) federal and 580 acres (6.7%) private, state or other.

Although the 1953 infestation is 2,790 acres larger than in 1952, control is not recommended for the following reasons: (1) The defoliation is all of light intensity, (2) there has been no serious weakening of the affected trees and none have been killed by the budworm and (3) there is no abnormal bark beetle activity in the fir stands on or adjacent to the unit.

3. Malheur Unit - The spruce budworm was recorded in epidemic proportions on 191,520 acres on and adjacent to the Long Creek Ranger District of the Malheur National Forest in 1953. This is 8,320 acres less than that reported in 1952. The current infestations were classed as 71,850 acres (37.5%) light, 70,230 acres (36.7%) moderate and 49,440 acres (25.8%) heavy. The ownership is 116,950 acres (61.1%) federal and 74,570 acres (38.9%) private, state or other.

This unit was recommended by the Northwest Forest Pest Action Committee for treatment during the 1953 control project, but, due to a shortage of federal funds, it had to be eliminated. The entomological conditions justifying control in 1953 have changed but little and control in 1954 is warranted entomologically. Nearly two-thirds of the unit contains moderate or heavy infestations. While there are no abnormal populations of bark beetles on or near the unit, much of the fir timber has been so weakened that widespread killing by both the budworm and bark beetles could easily occur. The only factors which would favor postponement of control are the relatively low value of the affected stands and the isolated position of this infestation with respect to previously treated units.

4. Susanville Unit - On this unit, located on and adjacent to the Blue Mountain Ranger District of the Whitman National Forest, a marked reduction in the size and intensity of spruce budworm infestations was found in 1953 over that reported last year. In 1953, only 13,700 acres of infestation were recorded on this unit, all of which was of light epidemic intensity. This is a decrease of 11,100 acres since 1952. The intensity of infestation also has decreased. The ownerships of the 1953 infestation are 9,900 acres (72.3%) federal and 3,800 acres (27.7%) private, state or other.

From an entomological standpoint, control of this infestation is not justified. The infestation is generally light, tree killing by the budworm is not imminent and there is no abnormal bark beetle activity in the affected stands.

5. La Grande Unit - Epidemic budworm infestations in the fir stands of the La Grande, Oregon watershed, totalling 51,490 acres, were recorded during the 1953 survey. This outbreak was classified as 39,180 acres (76.1%) light, 11,920 acres (23.1%) moderate and 390 acres (1.8%) heavy. The ownership is 27,230 acres (52.9%) federal and 24,260 acres (47.1%) private, state or other.

Control measures on this unit in 1954 are strongly recommended for the following reasons: (1) Adjoining treated units have already been reinfested from this infestation and further reinfestation is probable, (2) tree-killing by the budworm is imminent, and (3) important watershed values are being threatened.

6. Powder River Unit - The 1953 survey recorded a total of 41,820 acres of epidemic infestation in this unit. While this appears to be a marked increase over that reported in 1952, part of the increase is explained by a change in the boundaries of the La Grande and Powder River Units. The current outbreak on the Powder River Unit is classified as 33,950 acres (81.2%) light and 7,870 acres (18.8%) moderate, with 97.8 percent in federal ownership.

The present epidemic on this unit has not as yet reached the tree killing stage and control measures in 1954 do not appear warranted. However, if control on the Baker Watershed Unit is undertaken, the Powder River Unit should also be seriously considered from an operational standpoint.

7. Baker Watershed Unit - This unit, of 19,590 acres of epidemic infestation, is a continuation of the Powder River Unit. It has been separated from the latter because it is the drainage that supplies the city of Baker, Oregon with its municipal water supply. The infestation is classified as: 16,130 acres, (82.3%) light and 3,460 acres (17.7%) moderate. The ownership is 11,390 acres (58.1%) federal and 8,200 acres (41.9%) private, state or other.

In 1952, this outbreak consisted mostly of moderate defoliations that had reached epidemic proportions rather quickly. In 1953, the bulk of the infestation was in the light epidemic category. Although this outbreak is in an important watershed, the advisability of control is debatable. From an entomological standpoint, the infestation has not yet reached tree killing intensity and there is little abnormal bark beetle activity in the fir stands. If tree killing by the budworm or bark beetles becomes severe, it is doubtful whether the loss of timber would have a serious effect on the city water supply for the following reasons: (1) The fir timber is largely confined to the canyon bottoms and (2) there is ample ground and brush cover in the canyon bottoms to prevent serious water runoff in the event of tree killing. Perhaps the main argument for control of the budworm in 1954 would be to reduce the forest fire hazard which might develop in defoliated stands.

8. Eagle Creek Unit - A total of 46,410 acres of spruce budworm epidemic infestations in the Eagle Creek drainage on the Whitman National Forest was recorded during the 1953 survey. Although this is practically the same as the acreage reported in 1952, the degree of defoliation is different. The current outbreak is classified as: 18,440 acres (39.7%) light, 21,570 acres (46.5%) moderate and 6,400 acres (13.8%) heavy. In 1952, the degrees of infestation were 27.9%, 69.0% and 3.1% respectively.

Repeated defoliations by the budworm have seriously weakened and deformed the fir in this drainage, but as yet there has been no appreciable tree killing. Control measures were not recommended in 1952 because of a minimum of heavy defoliation, a slight likelihood of the spread of the infestation, generally low fir commercial timber values, and the difficult flying conditions on the unit. Although there is 10 percent more heavy defoliation in 1953, the treatment of this unit is not recommended in 1954.

9. Moss Spring Unit - Epidemic infestation of the spruce budworm in 1953 in the upper Minam River Drainage on the Wallowa National Forest covered 2,860 less acres than in 1952. The 1953 infestation totals 24,020 acres, of which 8,330 acres (34.7%) are light, 13,000 acres (54.1%) are moderate and 2,690 acres (11.2%) are heavy, with 99.4 percent in federal ownership. The 1952 infestation was all in the moderate category.

Control of this outbreak is not recommended on the basis of low commercial timber values and the difficulty of spraying operations.

10. Joseph Unit - The 1953 survey recorded an increase of 18,880 acres of budworm epidemic infestations in the Joseph Unit on the Wallowa National Forest over that reported in 1952 as well as an increase in the amount of heavy defoliation. The current infestation totals 133,760 acres, of which, 48,050 acres (35.9%) are light, 53,880 acres (40.3%) are moderate and 31,830 acres (23.8%) are heavy. The ownership is 116,010 acres (86.7%) federal and 17,750 acres (13.3%) other.

This epidemic has been present for several years. It has shown a steady increase in size and intensity since 1951 without an appreciable loss of timber. Tree killing is now becoming more evident. Control of this outbreak has not been recommended because of low commercial timber values and the isolated nature of the unit. No control measures are considered necessary in 1954.

11. Snake Unit - Epidemic infestations of the spruce budworm have been present in the Snake River drainage on the Wallowa National Forest for several years. Tree killing by the budworm is becoming more evident in the canyon bottoms, but, as yet, has not reached appreciable proportions. The 1953 survey recorded a total of 158,130 acres of infestation in this unit, which is 33,870 acres less than that reported in 1952. The current infestation is classed as: 63,800 acres (40.3%) light, 81,760 acres (51.7%) moderate and 12,570 acres (8.0%) heavy. The ownership is 155,620 acres (98.4%) federal and 2,510 acres (1.6%) other.

In the past, the low commercial timber values and the isolated position of this unit have not justified budworm control operations. Control in 1954 would be unwarranted for the same reasons.

12. Chesnimus Unit - The 1953 acreage of spruce budworm epidemic infestations on this unit, which is located in the northeastern portion of the Wailloa National Forest, is practically the same as in 1952 but the severity of the defoliation has lessened. The 1953 survey recorded a total of 92,100 acres of infestation, which was classified as: 17,060 acres (18.5%) light, 58,690 acres (63.7%) moderate and 16,350 acres (17.8%) heavy. The ownership is 89,420 acres (97.1%) federal and 2,680 acres (2.9%) other. In 1952, the infestation was classed as 64.8 percent moderate and 35.2 percent heavy.

In 1952, the outbreak on this unit had reached a point where control was justified in order to prevent heavy killing of timber by the budworm. However, timber values were deemed to be too low to warrant the expenditure of control funds. Because of this decision, control of this epidemic in 1954 would not be warranted.

13. Troy Unit - Epidemic infestations on this unit, which extend north of the Wenaha River to the Oregon-Washington line and are contiguous with the Saddle Mountain Unit in Washington, were found to be of the same size and intensity in 1953 as they were in 1952. There are 24,320 acres of infestation, of which 9,760 acres (40.1%) are light, 12,480 acres (51.3%) are moderate and 2,080 acres (8.6%) are heavy. The ownership is entirely federal.

The killing of budworm-weakened trees by the Douglas fir beetle, which began in 1951, is continuing in 1953. Therefore, control of the budworm in these fairly high value stands is useless until the bark beetle epidemic subsides.

Blue Mountains - Washington Area

In dealing with the spruce budworm epidemic in the fir stands of the Blue Mountains-Washington Area, the Committee recommended control measures on a priority basis, with first consideration given to stands where tree killing by the budworm was in progress or imminent. Gratifying progress was made in carrying out these recommendations until a widespread epidemic of bark beetles in both Douglas fir and true firs, which started in 1951, called a halt to further aerial spraying projects for budworm control in this area. The 1953 survey found the bark beetle epidemic to be more severe and widespread than in 1952. Therefore, consideration of the budworm problem in this area becomes purely academic until the beetle epidemic returns to a normal status.

A record of the spruce budworm infestations and the control operations conducted in this area is as follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zones)</u>
1947	45,000 Acres		
1948	126,000 Acres		
1949	165,000 Acres	1950	25,853 Acres
1950	295,000 Acres	1951	115,672 Acres
1951	182,880 Acres	1952	134,612 Acres
1952	127,200 Acres	1953	None
1953	118,880 Acres		

In 1952, a total of 127,200 acres of spruce budworm epidemic infestations was reported on the Tucannon, Wolf Creek and Saddle Mountain Units in the Blue Mountains-Washington Area. The 1953 survey recorded similar infestations totalling 118,880 acres on only one unit - the Saddle Mountain Unit. On the other two units, it was found that tree killing by bark beetles so far outweighed the defoliation by the budworm that it was impossible to map the defoliated stands. Because the budworm can be found throughout this area, no organized ground sampling surveys have been conducted.

The budworm situation in 1953 on the one unit in this area is as follows:

14. Saddle Mountain Unit - A total of 118,880 acres of mixed fir, alpine and non-commercial timber types in the Pomeroy Ranger District of the Umatilla National Forest were defoliated by the budworm in 1953. The intensity was classified as: 6,880 acres (5.8%) light, 99,520 acres (83.7%) moderate and 12,480 acres (10.5%) heavy. This is the same total acreage and same intensity as reported in 1952. Likewise, the ownership remains the same, 58.6 percent federal and 41.4 percent private, state or other.

While defoliation by the budworm on this unit has remained static, tree killing by bark beetles has become more severe. As in 1952, further control of the spruce budworm in these predominately low-value stands is unwarranted until the bark beetle epidemic subsides. While the budworm poses some threat to the adjoining treated stands in this area, most of them are already heavily infested by bark beetles.

Eastern Washington Cascades Area

Between 1943 and 1950 the spruce budworm was intermittently recorded in moderate epidemic proportions in Chelan and Okanogan Counties of this area. These infestations subsided without any appreciable loss of commercial timber. It was not until 1950 that a potentially serious outbreak of the budworm in the Icicle Creek drainage of the Wenatchee National Forest focused attention on the need for control measures. This outbreak was brought under control in 1951. Because of the hazardous spraying conditions encountered on this unit, subsequent control of the budworm in adjoining stands has not been considered practical. The outbreak has not spread extensively. A record of the budworm epidemics since 1947 and the control in this area is as follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zone)</u>
1947	197,600 Acres		
1948	(no survey)		
1949	(Surveyed - no infestation)		
1950	25,440 Acres	1951	9,420 acres
1951	3,840 Acres	1952	None
1952	19,840 Acres	1953	None
1953	22,720 Acres		

Ground surveys to record endemic budworm infestations in this area have not been extensive. A small series of permanent plots, to be examined by co-operating forester, was suggested in 1953; however, none was actually established. Twenty seven sampling points, previously established were re-examined.

The spruce budworm situation on the one unit of epidemic infestation recorded during the 1953 survey is as follows:

15. Wenatchee Unit - The 1953 survey recorded a total of 22,720 acres of epidemic budworm infestations in the same general stands as that reported in 1952. The current infestation is 2,980 acres larger than in 1952 and is classified as: 4,640 acres (20.4%) light, 11,360 acres (50.0%) moderate and 6,720 acres (29.6%) heavy. The ownerships is 13,280 acres (58.6%) federal and 9,440 acres (41.4%) private, state or other.

In 1952 it was recommended that the control of the reported epidemic in 1953 be postponed for the following reasons: (1) Extremely difficult and hazardous operational problems, and (2) the known tendency for outbreaks in the general vicinity to subside before tree killing by the budworm occurs. Although the 1953 acreage of epidemic infestation on this unit is slightly larger than in 1952, it is felt that control measures should be postponed for the same reasons.

Discussion and Recommendations

The spruce budworm situation in Oregon and Washington in 1953 is greatly improved over that reported in 1952. Although there are still 1,136,000 acres of epidemic infestations in the two states in 1953, this is the lowest acreage of spruce budworm damage recorded since 1947.

The aerial spraying program, recommended by the Northwest Forest Pest Action Committee and covering 3,152,247 acres during the period 1949-1953, has proven outstandingly successful in preventing the destruction of the fir resources of the two states by the spruce budworm. The potentially serious epidemic infestations in western Oregon and in the eastern Oregon Cascades have been eliminated. On extensive areas in the Blue Mountains and on a small area in eastern Washington, the infestations have been greatly reduced. The build-back of budworm populations on treated units has remained satisfactorily low.

As reported in 1952, the spruce budworm problem in Oregon and Washington has become exceedingly complicated by an aggressive epidemic of bark beetles, particularly the Douglas fir beetle, in the budworm-weakened stands of the Blue Mountains. On most of these units, further control of the budworm is futile until the bark beetle epidemic subsides. On other units when signs of bark beetle outbreaks begin to develop, spraying for budworm control probably should be undertaken at an earlier stage than heretofore.

In view of the findings of the 1953 survey, the 15 units of epidemic infestation can be segregated into 5 groups for purposes of planning spruce budworm control operations in 1954, as follows:

1. The Saddle Mountain and Troy Units can be eliminated because of the hopelessly complicated budworm-bark beetle problem.
2. The Chesnimnus, Joseph, Snake, and Moss Spring Units can be eliminated because the low commercial timber values present on the units would not justify control expenditures.
3. The Wenatchee and Eagle Creek Units can be eliminated because of the difficult and hazardous operational problems to be encountered in treating these areas.
4. The Ochoco, Susanville and Aldrich Mountain Units are currently supporting a light budworm epidemic which could be allowed to continue for at least two years without causing appreciable damage.
5. The four remaining units, La Grande, Malheur, Baker Watershed and Powder River warrant consideration for control in the following order of decreasing importance:
 - a. La Grande
 - b. Malheur
 - c. Baker Watershed
 - d. Powder River

PART II - OTHER MAJOR FOREST PEST PROBLEMS

During the course of the regional forest insect survey of 1953, an effort was made to record all epidemic outbreaks of the major forest insect pests in Oregon and Washington. A summary of the acreages infested by seven species of bark beetles and six species of defoliators is given in Table 6. The areas infested by the three currently most important insects, other than the spruce budworm, are shown on Map 2. Because the survey of southwestern Oregon has not been completed, there may be additional acreages of damage caused by some of these pests.

Data were also taken on the damage caused by bears in the western portions of the two states, blister rust in western white pine stands, Rhabdocline needle cast disease of Douglas fir, needle cast disease in ponderosa pine stands, and damage to western hemlock from an unknown cause in western Washington. The infection of Rhabdocline needle cast disease of Douglas fir in 1953 was particularly widespread and severe on the Umatilla and Whitman National Forests. The presence of this disease complicated the spruce budworm aerial survey because of the similarity of the damage. Careful and extensive ground checking in the affected stands was necessary to differentiate the stands damaged by this disease from those defoliated by the budworm.

The following sections, in which the current situation is discussed by insects, are numbered to agree with Table 6. More detailed data on the various insects and the other agents causing forest damage in 1953 are on file and can be obtained on request.

1. Douglas Fir Beetle (*Dendroctonus pseudotsugae*)

The 1953 survey showed that the Douglas fir beetle was epidemic on approximately 4,832,800 acres in 1952 (Map 2 and Table 6). This includes an estimated 600,000 acres in southwestern Oregon on an area not yet fully surveyed. Figures for 1953 will not be available until the 1954 survey because only a small percentage of the beetle-killed trees can be detected in the year of attack. A breakdown of the area of epidemic infestation in 1952 by subregions and states follows:

Eastern Washington	254,400 Acres
Western Washington	424,500 Acres
Total for Washington	<u>678,900 Acres</u>
Eastern Oregon	600,400 Acres
Western Oregon	3,553,500 Acres
Total for Oregon	<u>4,153,900 Acres</u>
GRAND TOTAL	4,832,800 Acres

Although the epidemic infestations in the region in 1952 were some 262,700 acres greater than in 1951, there was a decline of approximately 191,000 acres in the high-value westside fir stands. The acreage of damage in eastern Oregon and Washington increased by some 453,600 acres, or more than double that of 1951.

The special cooperative survey of 1952 ^{1/} determined that more than one billion board feet net of Douglas fir was killed by the beetle in 1951, the first year of the outbreak, and 9 billion feet of timber was blown down. During the spring of 1953 a follow-up special survey was made in westside stands to assess both the blowdown and beetle-killing that occurred after the initial evaluation of the catastrophe. This survey showed that an additional 1½ billion feet was windthrown during the winter of 1952-1953. The bulk of the new blowdown was in Washington.

^{1/} Final Report on the 1952 Blowdown and Bark Beetle Survey in the Douglas-Fir Region of Oregon and Washington. Pacific Northwest Forest and Range Experiment Station and Bureau of Entomology and Plant Quarantine. Multilithed Report, July, 1953.

The volume of timber killed by the Douglas fir beetle in 1952, which is being measured by photographic methods, has not yet been summarized. It is apparent from completed work that considerable additional mortality has occurred, but the amount is much reduced in most areas from that occurring in 1951. The status of the infestation is variable from area to area. A few localities show increases in intensity of damage, while some others are nearly static at epidemic levels.

The infestation in westside stands, which is largely traceable to the major blowdown, continues to be especially aggressive in the Oregon Coast Range between the Siuslaw and Umpqua Rivers, and to a lesser extent in the Millicomma and Coos River drainages. There has been a general decline in most of the infested zone west of the Cascade Range in both Oregon and Washington. Exceptions to this trend are the upper Clackamas River, and parts of the Little White Salmon, Wind, and Cowlitz River drainages where the epidemic is still virulent.

The Douglas fir beetle situation in the eastside stands, where the principal infestation is in the Blue Mountains subregion of both Oregon and Washington, remains highly aggressive. The worst areas of infestation are on the Umatilla National Forest in localities that have been defoliated by the spruce budworm for several years. In some drainages almost all the Douglas fir of saw timber size is being killed. Considerable tree mortality was also recorded on the Wallowa, Whitman, and Mt. Hood National Forests in Oregon; and the Chelan, Wenatchee and Snoqualmie Forests in Washington. Although the quality and volume of the Douglas fir in these eastside stands is considerably lower than that in the western Oregon and Washington outbreaks, it is a serious loss in many areas. Prompt salvage to utilize the dead timber before major deterioration occurs is recommended.

Much progress in the salvage of the beetle-kill and blowdown in western Oregon and Washington has been made. Still a large percentage of the total remains in the woods. Deterioration studies by the Division of Forest Pathology, Weyerhaeuser Timber Company and the Portland Forest Insect Laboratory show that rot and borers already have caused considerable deterioration to the insect-killed and windthrown timber, especially the young timber. The importance of continuing and expanding the salvage program cannot be over-emphasized.

2. Western Pine Beetle (*Dendroctonus brevicomis*)

In 1950, after a period of nearly 10 years of normal losses, the western pine beetle suddenly began extensive group killing of ponderosa pine in Oregon and Washington. Each year since then the acreage of epidemic infestation by the beetle has increased, as shown by the following comparison:

<u>Year of Survey</u>	<u>Year of Loss</u>	<u>Infested Acreage</u>
1951	1950	303,000
1952	1951	673,800
1953	1952	1,001,100

With the single exception of the Klamath Indian Reservation, all major stands of ponderosa pine in the two states were found to have sustained epidemic western pine beetle losses in 1952 (Map 2 and Table 6). The heaviest losses in 1952 were recorded on the following forests:

Yakima Indian Reservation	196,800 acres
Deschutes National Forest	186,300 acres
Fremont National Forest	146,600 acres
Warm Springs Indian Reservation	94,900 acres
Ochoco National Forest	82,200 acres
Umatilla National Forest	63,500 acres

The losses on the Yakima Indian Reservation and the Deschutes and Fremont National Forests were serious in 1951. Losses were even more serious in 1952. On one 320-acre survey check plot on the Yakima Indian Reservation, situated in the heaviest portion of the epidemic, 239 mature pines were killed by the western pine beetle in 1952. Salvage logging of the heaviest centers of infestation is now in progress. On the Deschutes National Forest, the currently infested trees on some 40 to 50 sections are being marked for cutting and removal prior to beetle emergence in 1954. On other forests, salvage logging has been strongly recommended. It is encouraging to note that the current surveys showed that the trend of this epidemic seems to have turned downward in 1953. The number of trees killed in 1953 will probably be well below the level of the 1952 loss.

3. Mountain Pine Beetle (*Dendroctonus monticolae*)

The number of centers and the total acreage of epidemic infestations of the mountain pine beetle in 1953 were noticeably higher than in 1952. Some 331 separate centers and 322,400 acres of damage were recorded in lodgepole pine, western white pine, ponderosa pine and sugar pine in Oregon and Washington (Table 6.). The heaviest losses were found on the Wenatchee, Snoqualmie and Fremont National Forests. The outbreak on the Wanoga Butte Area of the Deschutes National Forest, which has been a threat to the extensive lodgepole pine stands in Deschutes and Klamath Counties for the past several years, has declined slightly. The centers of heavy tree killing in this outbreak have shifted and the total acreage is slightly less than that recorded last year. The outbreak in second growth ponderosa pine on and adjacent to the Whitman National Forest, which has also been present for several years, is perhaps the most serious mountain pine beetle problem in the region. Salvage of the dead and currently infested trees is recommended.

4. Fir Bark Beetles (Pseudohylesinus)

Silver fir mortality of epidemic proportions has been occurring in the Pacific Northwest since 1947. In that year several hundred acres of moderate to heavy damage were noted in the mixed fir-hemlock stands south of Mt. Baker in the State of Washington. The first region-wide aerial reconnaissance survey, in 1949, showed varying degrees of damage spread over much of the Mt. Baker area. Since that time the area of damage has increased until it now includes a large area on the Olympic Peninsula and other scattered areas in western Washington and Oregon. The cause of the damage is attributed to two species of fir bark beetles, Pseudohylesinus granulatus (Lec.) and P. grandis Sw., combined with root rots.

The 1953 silver fir mortality due to these pests is the heaviest yet recorded (Map 2 and Table 6.) From the Canadian border in western Washington to the McKenzie River in west-central Oregon a great many of the timber stands containing silver fir show evidence of damage. The intensity of this damage from area to area is quite variable with some areas suffering much greater mortality than others. The following tabulation summarizes the intensity of the 1953 damage according to four degrees of infestation.

<u>Number of Centers of Infestation</u>	<u>Intensity of Infestation in Acres</u> ^{1/}				<u>Total</u>
	<u>Light</u>	<u>Moderate</u>	<u>Heavy</u>	<u>Very Heavy</u>	
107	330,000	180,000	68,400	25,000	603,400

Practically all of the acreage of "heavy" and "very heavy" infestation is in the Mt. Baker area. There are centers of damage in that area in which nearly all of the silver fir has been killed. The total acreage of critical damage continues to increase.

The loss of silver fir has also increased in terms of total acres affected. The following table shows the total acres of current damage in comparison with damage in past years.

<u>Year</u>	<u>No. of Centers of Infestation</u>	<u>Total Acres</u>
1949	108	38,000
1950	37	55,000
1951	129	243,000
1953	107	603,400

The above survey data show a continuous increase in the amount of damage from 1949 to the present time. Unless some natural control factor should suddenly check the outbreak, we can expect continued heavy damage in 1954.

^{1/} Intensity of Infestation refers to the degree of mortality where "light" is 40-80 trees per section; "moderate" is 80-160 trees per section; "heavy" is 160-320 trees per section; and "very heavy" is over 320 trees per section.

Considerable research has been done on these insects, but as yet no feasible method of direct control has been developed. The best that can be done at present is to salvage-log the centers of critical damage as rapidly as possible.

5. Fir Engraver Beetles (Scolytus)

Outbreaks of Scolytus in stands of true firs in Oregon and Washington are almost an annual occurrence. The 1953 survey recorded 113 centers of infestation covering 118,100 acres, mostly in Oregon (Table 6). The heaviest damage was found on the Rogue River National Forest. Most of these outbreaks are in non-commercial timber. No effective measures for controlling Scolytus have yet been developed.

6. Pine Engraver Beetles (Ips)

Killing of ponderosa pine reproduction and stands of small second growth by pine engraver beetles occurs annually in Oregon and Washington. The 1953 survey recorded 122 centers of infestation covering 75,700 acres, with the heaviest losses on the Umatilla, Whitman and Wallowa National Forest (Table 6). This damage was less than that reported in 1952 and considerably below the level of damage found during the so-called "Ips years," when tremendous group-killing occurs throughout the region. No control is necessary.

7. Engelmann Spruce Beetle (Dendroctonus engelmanni)

Seven centers of epidemic outbreaks of the Engelmann spruce beetle, covering 7,500 acres and representing trees killed in 1952, were recorded on the Gifford Pinchot and Snoqualmie National Forests and on the Olympic National Park during the 1953 survey. Most of these infestations (4 centers and 6,720 acres) were on the Tieton District of the Snoqualmie National Forest, where heavy killing in 1952 and some group killing in 1953 were evident on Pinegrass Ridge. The outbreak of this beetle observed in the Walla Walla Watershed in 1952 continued in 1953, but was too light to be recorded from the air. Salvage of the dead and currently infested trees on the Walla Walla area is in progress.

8. Spruce Budworm (Choristoneura fumiferana)

See Part I for detailed information.

9. Pine Budworm (Choristoneura retiniana)

Two centers of light epidemic defoliation by the pine budworm, covering 2,100 acres, were recorded in the ponderosa pine stands northeast of Ellensburg, Washington in 1953. This insect periodically attacks young ponderosa pine. While causing some "brooming" of the trees, the pine budworm has not caused tree mortality. No control measures are necessary.

10. Larch Bud Moth (*Zeiraphera griseana*)

Defoliation of western larch by the larch bud moth was found on only one forest in 1953. One center of moderate epidemic defoliation, covering 3,600 acres on the Crawford and Idaho Creek drainages of the Whitman National Forest, was recorded during the current survey. The epidemic on the Wenatchee National Forest which extended over 86,000 acres in 1951, appears to have subsided from natural causes. Although the defoliation caused by this bud moth is spectacular, it is usually of short duration and no control measures appear necessary.

11. Lodgepole pine sawfly (*Neodiprion*)

The lodgepole pine sawfly outbreak, that was reported last year for the first time, increased from 19,800 acres in 1952 to 69,700 acres in 1953. This outbreak is on the Willamette and Deschutes National Forests in Oregon. The affected trees are growing on poor sites and are generally of submerchantable value. Some 4000 acres of the heaviest infestations are on recreational and intensively used areas, such as Big Lake and Hoodoo ski bowl and along the Santiam and McKenzie highways.

The sawfly feeds only on the old needles; hence, it takes about three years to kill a tree. No complete defoliation has yet occurred. In the old centers of infestation only the severely stunted foliage of 1953 remains. Another year of heavy defoliation is certain to cause much killing. Some of the weakened trees already have been attacked and are being killed by secondary bark beetles. Experience in past outbreaks indicates that this type of killing is likely to increase. The defoliated trees probably are too small to cause a buildup of the mountain pine beetle, a primary killer of lodgepole pine.

Past sawfly outbreaks in this region have generally succumbed to disease. At least one recorded outbreak was largely controlled by insect parasites. So far there has been no evidence of disease in the present infestation. There has been a marked increase in parasitism. Rearings in the fall of 1952 showed less than one percent parasitism as compared with about 20 percent in the fall of 1953. Even so, it is evident that the sawfly population in 1954 will be very great.

Approximately 1200 acres around Big Lake, Hoodoo Ski bowl, and Pine Ridge Lake were sprayed in 1953 in conjunction with the spruce budworm project on the Willamette National Forest. The urgency of the budworm work was such that some of the sawfly larvae matured and pupated before the sawfly area could be sprayed. However, the spraying showed conclusively that the sawfly can be readily killed by the aerial application of DDT. The work in 1953 also showed that the development of the sawfly is uneven to the extent that two spray applications in a single year may be necessary to effect complete control.

12. White Fir Sawfly (*Neodiprion*)

The 1953 survey recorded one center of 1,300 acres of light epidemic defoliation of white fir by a sawfly in the Camas Creek drainage on the Wenatchee National Forest. Although, the spruce budworm was found to be attacking the same trees, the damage by the sawfly was more pronounced. No control measures are warranted.

13. Spruce Aphid (*Neomyzaphis abietina*)

Defoliation by this insect has been prevalent in Sitka spruce stands along the Oregon and Washington coast for at least the last 3 years and has now reached tree-killing intensities in some areas. The aphid causes damage by feeding on the old needles from early spring to about midsummer. Outbreaks several years ago killed large quantities of spruce along the tidelands of Oregon and Washington and along the Columbia River.

Intensity of damage from the present outbreak is variable throughout the infestation zone. It has been observed as causing some tree mortality in restricted localities from Seaside to Coos Bay along the Oregon Coast. Damage is particularly heavy near the towns of Seaside, Cannon Beach, Neskowin and Taft. Reports and some limited observations indicate damage is equally heavy in Washington. The 1953 aerial survey recorded 23 centers covering 20,500 acres of epidemic infestation along the Oregon coast and 3 centers covering 2,100 acres in Washington that were heavy enough to be seen from the air (Table 6). Defoliation to some degree probably exists throughout the spruce belt.

No direct control measures have been developed to control this insect. Continued damage at the present level may seriously interfere with management plans in spruce-hemlock types. Forest owners are urged to maintain close observation of this potentially destructive insect.

14. Hemlock Looper (*Lambdina fiscellaria lugubrosa*)

No epidemic centers of defoliation by this important defoliator were found during the 1953 survey. The centers of infestation in western Washington, which have been under close observation during the past two years, have disappeared without causing appreciable tree mortality. Because of the destructive potential of the hemlock looper, all hemlock stands in western Oregon and Washington will continue to be carefully observed to detect incipient outbreaks of this insect.

During the 1953 survey, six centers of dying hemlock in western Washington covering 17,300 acres were recorded. The exact cause of this damage is unknown; however, a root fungus, combined with physiological disturbances, are thought to be responsible for this damage. These centers will be carefully observed during subsequent surveys. Where the affected stands are accessible, salvage of the dead trees should be undertaken as rapidly as possible.

PART III - APPENDIX

Acknowledgments

As in past years, the cooperative efforts of many individuals and organizations were necessary to complete the 1953 forest insect survey project in Oregon and Washington.

The 1953 Douglas fir bark beetle-blowdown survey, under the supervision of Mr. R. B. Pope of the Pacific Northwest Forest and Range Experiment Station, was a cooperative project between the Oregon State Board of Forestry, Washington State Division of Forestry, Bureau of Land Management, Pacific Northwest Forest and Range Experiment Station and the Bureau of Entomology and Plant Quarantine. A list of personnel on this project will be recorded in the report covering the findings of this survey.

The 1953 regional aerial survey was a cooperative undertaking between the Weyerhaeuser Timber Company, Oregon State Board of Forestry, Washington State Division of Forestry and the Bureau of Entomology and Plant Quarantine. The forests of Oregon were surveyed with the Oregon State Board of Forestry Cessna 170, with a crew consisting of Mr. A. Larsen, pilot and observer and Mr. M. Ramsdell, pilot, for the State and Mr. W. J. Buckhorn, observer and mapper. Most of the Washington forests were surveyed with a Cessna 180 of the Bureau of Entomology and Plant Quarantine with a crew consisting of Mr. R. M. Lamoureux, pilot, and Mr. W. J. Buckhorn, observer and mapper, both of the Bureau, and Mr. F. Murphy of the Washington State Division of Forestry, observer and radio operator.

The Cessna 170B of the Weyerhaeuser Timber Company, with a crew consisting of Mr. Bartel, pilot, and Mr. P. Lauterbach, observer, for the company and Mr. W. J. Buckhorn as observer and mapper, covered the hemlock stands of western Washington.

The ground checking of the regional survey findings was done by Mr. A. Gruba of the Oregon State Board of Forestry, Messrs. W. J. Buckhorn and P. W. Orr of the Bureau of Entomology and Plant Quarantine.

A list of the individuals participating in the 1953 spruce budworm ground survey in Oregon and Washington is given in Tables 4 and 5.

The compilation of the regional survey findings was done by Messrs. A. Gruba, A. Larsen, D. McComb, M. Ramsdell of the Oregon State Board of Forestry and Mr. W. J. Buckhorn and V. Poole of the Bureau of Entomology and Plant Quarantine. The large-scale maps, showing the 1953 infestations, were prepared by Messrs. Gruba and Ramsdell and the base maps for Maps 1 and 2 in this report were prepared by Messrs. A. Larsen, W. J. Buckhorn, and J. F. Wear.

TABLE 3. SUMMARY OF 1953 COOPERATIVE FOREST INSECT AERIAL SURVEY
(Exclusive of Special Douglas Fir Beetle Surveys)

AREA AND AGENCY	Aircraft Used	Timbered Acres Surveyed	Air Miles Flown	Mapping Hours	Ferry Hours	Total Survey Hours
Western Oregon *	OSBF	14,010,425	5,310	49.5	3.6	53.1
OSBF & BEPQ	Cessna 170					
Eastern Ore.Cascades	OSBF	6,590,480	2,910	26.4	2.7	29.1
OSBF & BEPQ	Cessna 170					
Blue Mountains	OSBF	6,963,975	3,590	32.8	3.1	35.9
OSBF & BEPQ	Cessna 170					
Eastern Wash.Cascades	BEPQ	8,001,109	3,900	27.0	3.0	30.0
WDF & BEPQ	Cessna 180					
Western Washington	BEPQ	11,774,045	5,790	41.7	3.5	45.2
WTC, WDF, BEPQ	Cessna 180					
	WTC		1,100	11.0	0	11.0
	Cessna 170B					
TOTALS 1953 Survey		47,340,034	22,600	188.4	15.9	204.3
TOTALS 1952 Survey		34,827,564	17,826	151.8	19.1	170.9
TOTALS 1951 Survey		49,000,000	27,910	199.2	21.6	220.8
TOTALS 1950 Survey		48,229,354	26,580	182.1	21.1	203.2
TOTALS 1949 Survey		49,000,000	22,275	172.4	29.9	202.3

* Dense layers of smoke prevented the completion of the survey of about 1,600,000 acres in the Coos Bay - Roseburg area of southwestern Oregon. Whether this area can be surveyed in 1953 will depend upon the occurrence of at least two clear days.

OSBF - Oregon State Board of Forestry
WDF - Washington State Division of Forestry
WTC - Weyerhaeuser Timber Company
BEPQ - Bureau of Entomology and Plant Quarantine

TABLE 4. RESULTS OF 1953 COOPERATIVE SPRUCE BUDWORM GROUND SURVEY IN WASHINGTON

County	Agency	Observers	Survey Dates	No. Man Days	No. of Sample Plots		
					Present	Absent	Total
<u>WESTERN WASHINGTON</u>							
Clallam	Rayonier, Inc.	McDonnell, N.R. Schwab, C. A.	7/8	1.0	-	2	2
	WSDF	Bigger, D.	6/25	1.0	-	3	3
Clark	WSDF	Herman, K. E.	7/2-9	2.5	-	5	5
Cowlitz	Weyerhaeuser Timber Co.	Blinks, S.E.	6/24- 7/2	5.0	1	12	13
	WSDF	Herman, K.E. Shero, R. P. Ortwein, N.	7/7-9	4.0	-	5	5
Grays Harbor	Clemons Tree Farm	Guenther, W.J.	7/10	1.0	-	2	2
	Rayonier, Inc.	McDonnell, N.R. Schwab, C. A.	7/6-9	1.5	-	3	3
	South Olympic Tree Farm	Looney, W.S. Quinn	6/30 - 7/3	1.5	-	5	5
Jefferson	Crown Zellerbach Corp.	Homer, S.C. Willison, C.H.	7/2-6	2.0	-	3	3
	Rayonier, Inc.	McDonnell, N.R. Schwab, C. D.	7/7	1.0	-	2	2
King	Weyerhaeuser Timber Co.	Dowling, D. H. Franklin, F. Hendrickson, J. Meister, K. Olson, S.	6/30- 7/7	6.0	-	10	10
	WSDF	Haussman, J. Morris	6/23- 6/25	2.0	-	3	3

TABLE 4. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	No. of Sample Plots		
					Present	Absent	Total
Western Washington							
Lewis	Weyerhaeuser Timber Co. W.S.D.F.	Alexander, M.T.	7/1-10	2.5	-	5	5
		Blinks, S. E.					
		Haussman, J.	6-29-7/8	2.5	-	6	6
		Lash, M. Sedlacek, E.S.					
Mason	South Olympic Tree Farm	Looney, W.S. Quinn	6/30-7/3	2.0	-	7	7
Pacific	Clemons Tree Farm Crown Zellerbach Corp.	Chounard, M.	7/10	5	-	1	1
		Christy, W. H. Hough	6/24-6/30	1.5	-	3	3
Pierce	Weyerhaeuser Timber Co. W.S.D.F.	Franklin, F.	7/1	1.0	-	2	2
		Hendrickson, J.					
		Haussmann, J.	6/30-7/10	3.5	-	8	8
		Lash, M. Morgan, R. Vandercock, L.					
Skagit	Weyerhaeuser Timber Co.	Bowman, H.	7/13-7/17	2.0	-	4	4
		Carey, C.					
		Anderson, T. M. Benham, R Foss, J.	7/14-7/20	2.5	-	6	6
Snohomish	Weyerhaeuser	Bowman, N.	6/26-7/17	4.5	-	12	12
		Carey, C.					
		Gruenfeld, J.					
		Yonke, D.					
	W.S.D.F.	Knutson, H. Lindley, E.	6/29-7/8	1.5	-	4	4

TABLE 4. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	No. of Samples Plots		
					Present	Absent	Total
Thurston	Weyerhaeuser Timber Co.	Alexander, M.T.	7/5	.5	-	1	1
	W.S.D.F.	Sacheck, W. Taylor, D.	6/26	1.0	-	1	1
Wahkiakum	Crown Zellerbach Corporation	Christy, W.H. Hicks, W. Hough, E.	6/23-7/1	3.0	-	5	5
Whatcom		Daniels, S.R.	7/8	1.0	-	2	2
Subtotal for Western Washington				58.0	1	122	123
<u>EASTERN WASHINGTON</u>							
Klickitat	Longview Fiber Company	Loeb, J. H.	6/26-7/7	2.0	4	23	27
TOTAL FOR WASHINGTON				60.0	5	145	150

TABLE 5. RESULTS OF 1953 COOPERATIVE SPRUCE BUDWORM GROUND SURVEY IN OREGON

County	Agency	Observers	Survey Dates	No. Man Days	No. of Sample Plots		
					Present	Absent	Total
<u>WESTERN OREGON</u>							
Benton	O.S.B.F.	Hutsell, C. Popham, T.	8/11-8/13	4.0	-	5	5
Clackamas	Crown Zeller- bach Corp.	Clark, K.W. Trafton, G.B.	6/22-7/6	4.5	1	7	8
	Weyerhaeuser Timber Co.	Blinks, S.E.	6/26	1.0	-	3	3
	Mt. Hood NF (BEPQ)	Dobyns, L. Young, B.	7/30-8/6	5.0	5	3	8
Clatsop	Crown Zeller- bach Corp.	Mosar, R.M.	7/1-7/3	2.5	-	5	5
Columbia	Crown Zeller- bach Corp.	Pugsley, L.	6/23-6/24	2.0	-	4	4
	Longview Fiber Co.	Nye Robinson	6/25-6/26	2.0	-	12	12
Coos	Weyerhaeuser Timber Co.	Dawson, F. Gingery, D. McCowan, V. Rudinsky, J. Smyth, A.V.	6/29-7/26	5.5	-	7	7
	O.S.B.F.	Gruba, A.	8/18	.5	-	1	1
	Bureau of Land Management	Knepper, R. J. Lauch, J. Morrison, L.W. Peterson, E.J.	7/7-7/10	5.0	-	7	7
	Siskiyou N.F.	Stickney, D.B.	9/9	1.0	-	2	2
Curry	O.S.B.F.	Gruba, A. McClelland, J.	8/11-8/19	5.5	-	12	12
	Siskiyou N.F.	Ragland, W.E.	9/8	.5	-	1	1

TABLE 5. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	No. of Sample Plots		
					Present	Absent	Total
Douglas	Weyerhaeuser Timber Co.	Ehm, R. Gehrman, R. Ohman, R. Smyth, A.V.	7/23-7/27	2.5	-	4	4
	O.S.B.F.	Gruba, A. McClelland, J. Popham, T.	8/6-8/26	7.0	1	16	17
Jackson	Rogue River N.F.	Robinson, W.R.	8/10-9/22	6.0	-	15	15
Josephine	O.S.B.F.	Gruba, A. McClelland, J.	8/5-8/6	3.0	-	4	4
	Siskiyou N.F.	Bowerman, H.R. Hathaway Philbrick, J.R. Ritter, H.	8/7-9/4	2.5	-	3	3
Lane	Giustina Bros. Lumber Co.	Fox, D.D. Rodgers, C. E.	7/30	2.0	-	2	2
	Long Bell Lbr. Company	Foster, C.L.	7/7-7/9	2.5	-	5	5
	Weyerhaeuser Timber Co.	Ehm, R. Gehrman, R. Price, C.	7/12-7/24	3.0	-	7	7
	O.S.B.F.	Hutsell, C. Popham, T.	8/14-8/20	4.0	-	10	10
	Willamette N.F. (BEPQ)	Dobyns, L. Young, B.	8/10-8/14	4.0	8	8	16
	O.S.B.F.	Hutsell, C. Popham, T.	8/10-8/16	2.0	1	2	3
Lincoln	O.S.B.F.	Hutsell, C. Popham, T.	8/10-8/16	2.0	1	2	3

TABLE 5. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	No. of Sample Plots		
					Present	Absent	Total
Linn	Timber Service Co.	Groshong Penny Shaw	6/29-6/30	6.0	-	8	8
	Weyerhaeuser Timber Co.	Price, C.	7/20	1.0	1	5	6
	O.S.B.F.	Popham, T.	8/21-8/31	1.5	-	3	3
	Willamette N.F. (B.E.P.Q.)	Young, B.		1.0	4	3	7
Marion	Longview Fiber Co.	Anliker, J.M.	7/25-7/27	2.0	-	0	21
	Willamette N.F. (B.E.P.Q.)	Young, B.	8/6-8/7	1.5	2	3	5
Polk	Oregon Pulp & Paper Co.	Corlett, J.	7/30	.5	-	1	1
	Willamette Valley Lumber Co.	Bergman, M.	6/30-7/1	2.0	-	5	5
	O.S.B.F.	Hutsell, C.	8/10	2.0	-	2	2
		Popham, T.					
Tillamook	Crown Zellerbach Corp.	Kremers, J. Mosar, R.M.	6/24	1.5	-	3	3
	O.S.B.F.	Gruba, A. Hutsell, C. Larsen, A. Popham, T.	8/7-8/11	3.0	-	4	4
Washington	O.S.B.F.	Hutsell, C. Popham, T.	8/5	1.0	-	2	2
Yamhill	O.S.B.F.	Hutsell, C. Larsen, A. Popham, T.	8/6-8/7	3.0	-	4	4
	Bureau of Land Management	Christman, R.D.	7/13-7/14	1.0	-	2	2
Subtotal for Western Oregon				103.5	23	211	234

TABLE 5. (Continued)

County	Agency	Observers	Survey Dates	No. Man Days	No. of Sample Plots		
					Present	Absent	Total
<u>EASTERN OREGON</u>							
Deschutes	O.S.B.F.	Popham, T.	8/27-9/2	3.0	3	3	6
Jefferson	O.S.B.F.	Popham, T.	8/27-9/1	2.0	3	2	5
Klamath	O.S.B.F.	Popham, T.	9/2-9/4	2.0	2	2	4
	Rogue River N.F.	Robinson, W.R.	8/19-9/8	1.5	-	3	3
Wasco	Mt.Hood N.F. (BEPQ)	Young, B.	8/5	.5	1	-	1
	Warm Springs Indian Reservation (BEPQ)	Dobyns, L.	7/31	1.0	2	3	5
Subtotal for Eastern Oregon				10.0	11	13	24
TOTAL FOR OREGON				113.5	34	224	258
OREGON AND WASHINGTON TOTAL				173.5	39	369	408

TABLE 6. SUMMARY OF FOREST INSECT EPIDEMIC CENTERS OF INFESTATION RECORDED
DURING 1953 SURVEY IN REGION 6

Insect	Washington		Oregon		Region Total	
	No. of Cen- ters	Acres	No. of Cen- ters	Acres	No. of Cen- ters	Acres
BARK BEETLES						
1. Douglas Fir Beetle	283	678,900	548	4,153,900 ^{1/}	831	4,832,800 ^{1/}
2. Western Pine Beetle	43	278,600	251	722,500	294	1,001,100
3. Mountain Pine Beetle	227	209,400	104	113,000	331	322,400
4. Fir Bark Beetles	101	588,000	6	15,400	107	603,400
5. Fir Engraver Beetles	16	14,100	97	104,000	113	118,100
6. Pine Engraver Beetles	14	3,800	108	71,900	122	75,700
7. E. Spruce Beetle	7	7,500			7	7,500
Subtotal	691	1,780,300	1,114	5,180,700 ^{1/}	1,805	6,961,000 ^{1/}
DEFOLIATORS						
8. Spruce Budworm	4	141,600	13	994,420	17	1,136,020
9. Pine Budworm	2	2,100			2	2,100
10. Larch Bud Moth			1	3,600	1	3,600
11. Lodgepole Sawfly			8	69,700	8	69,700
12. White Fir Sawfly	1	1,300			1	1,300
13. Spruce Aphid	3	2,100	23	20,500	26	22,600
Subtotal	10	147,100	45	1,088,220	55	1,235,320
GRAND TOTAL	701	1,927,400	1,159	6,268,920 ^{1/}	1,860	8,196,320 ^{1/}

^{1/} Includes an estimated 600,000 acres of Douglas fir beetle damage in southwestern Oregon on an area not yet fully surveyed.

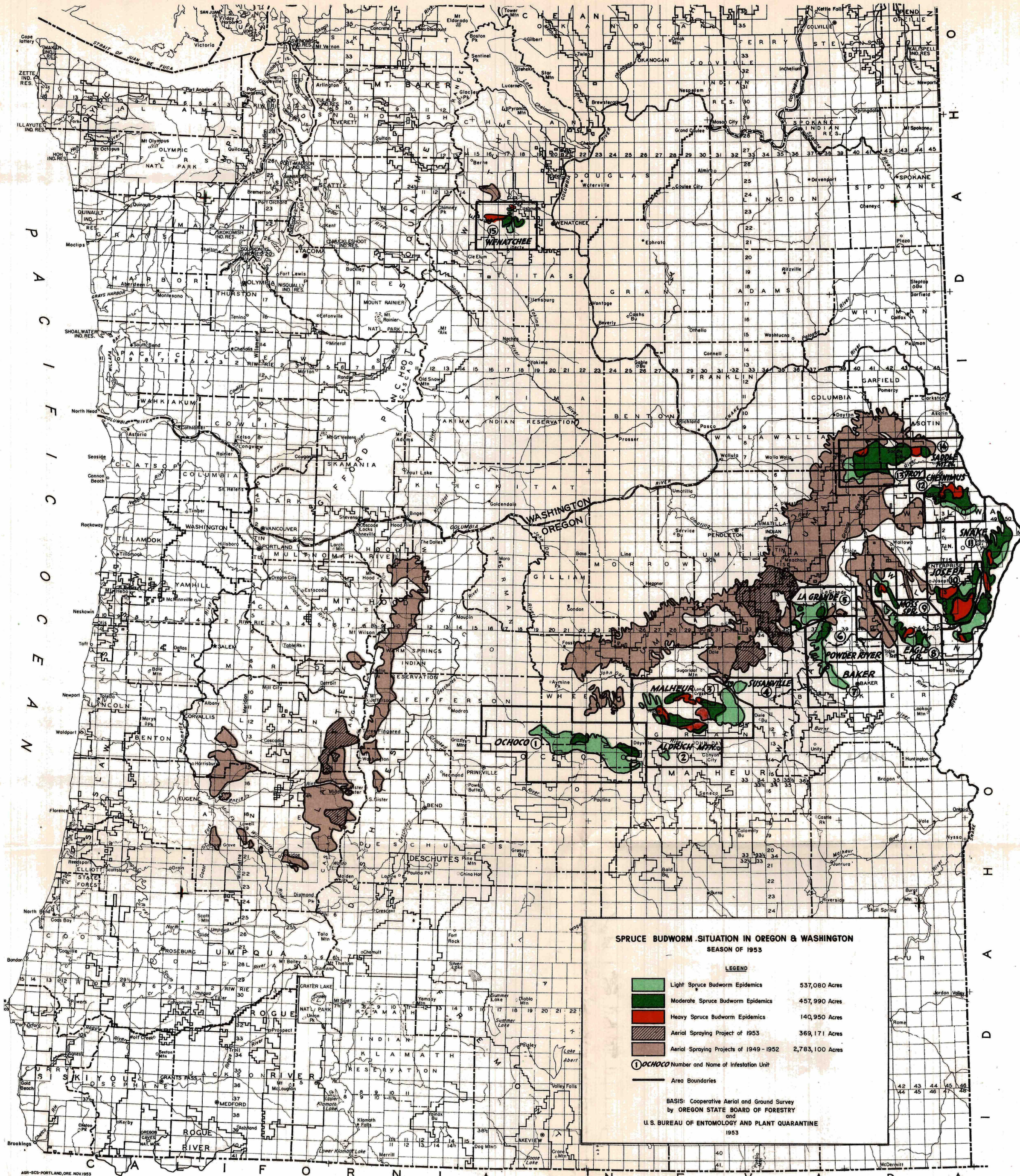
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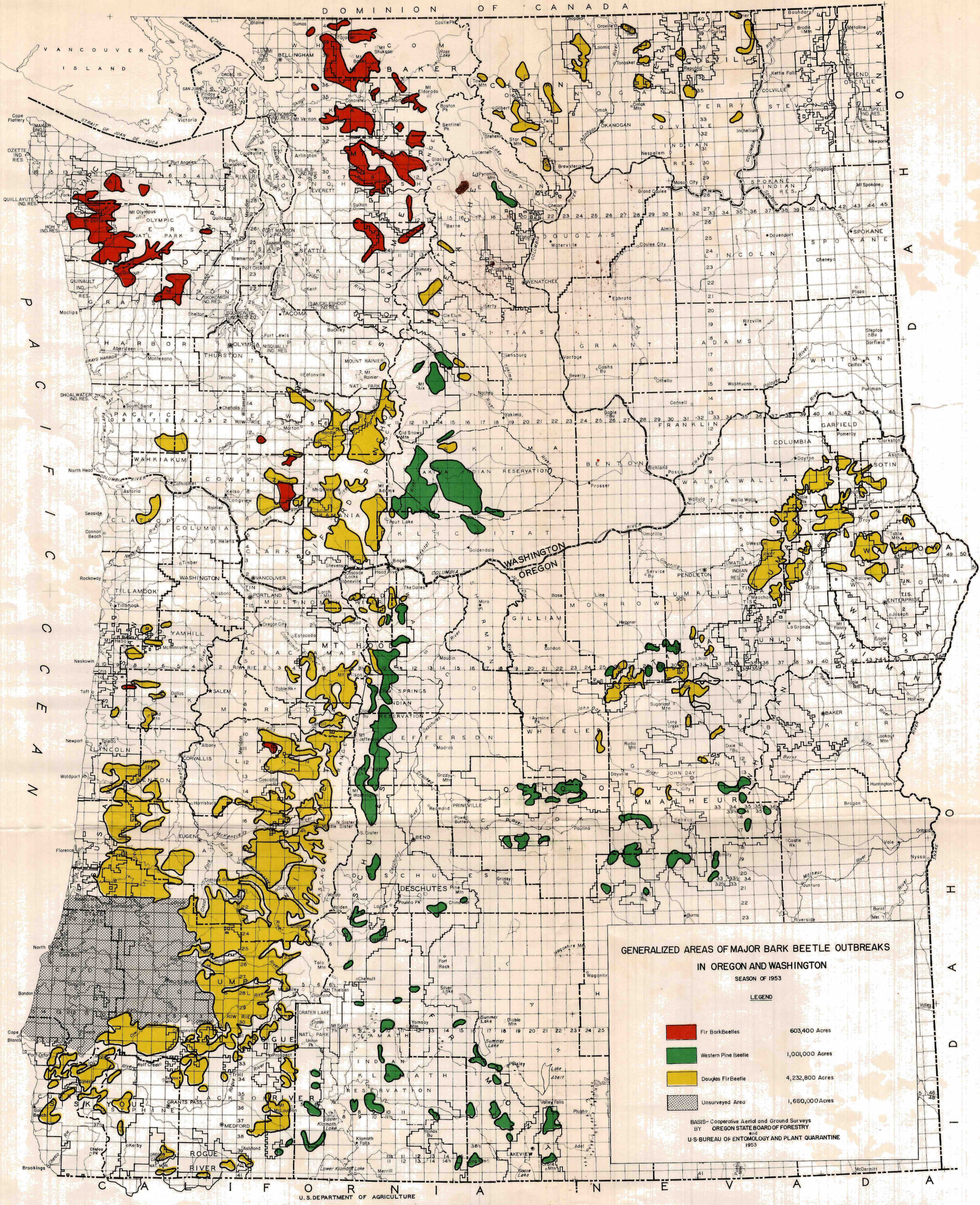
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MAP 1



MAP 2



GENERALIZED AREAS OF MAJOR BARK BEETLE OUTBREAKS
IN OREGON AND WASHINGTON
SEASON OF 1953

LEGEND

- Fir Bark Beetles 603,400 Acres
- Western Pine Beetle 1,001,000 Acres
- Douglas Fir Beetle 4,232,800 Acres
- Unsurveyed Area 1,660,000 Acres

BASIS- Cooperative Aerial and Ground Surveys
BY OREGON STATE BOARD OF FORESTRY
AND
U.S. BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
1953